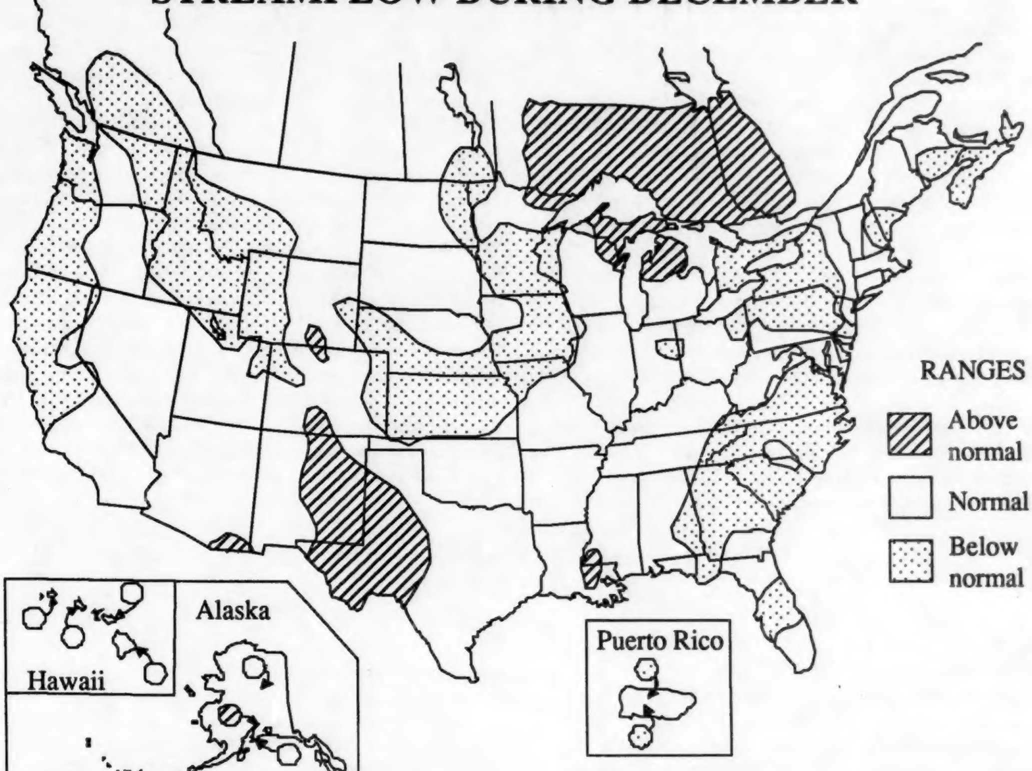
National Water Conditions

UNITED STATES
Department of the Interior
Geological Survey

CANADA
Department of the Environment
Water Resources Branch

DECEMBER 1988

STREAMFLOW DURING DECEMBER



Streamflow was in the normal to above-normal range at 60 percent of the reporting index stations in southern Canada, the United States, and Puerto Rico, during December compared with 80 percent in those ranges during last month. This is the lowest percentage of stations with flow in the normal to above-normal range for December in the last 7 years. Total December flow for the 179 reporting index stations in the conterminous United States and southern Canada was 17 percent below median, and the lowest for December in the last 7 years. Below-normal range streamflow occurred in 26 percent of the area of southern Canada and the conterminous United States during December compared with 22 percent during November, and a high of 60 percent during June.

The combined flow of the 3 largest rivers in the lower 48 States--Mississippi, St. Lawrence, and Columbia--was in the normal range during December after a 14 percent increase from November to December.

Monthend index reservoir contents for December 1988 were in the below-average range at 32 of 100 reporting sites, compared with 28 of 100 during November 1988. Lake Tahoe, straddling California and Nevada, had no usable storage for the third consecutive month.

Mean December elevations at the four master gages on the Great Lakes (provisional National Ocean Service data) declined from those for November except on Lake Huron. The monthly means were in the normal range on all four lakes.

The elevation of Utah's Great Salt Lake declined 0.05 foot to 4,206.45 feet above National Geodetic Vertical Datum of 1929 on December 15, and remained at that level through December 31

SURFACE-WATER CONDITIONS DURING DECEMBER 1988

Streamflow was in the normal to above-normal range at 60 percent of the 189 reporting index stations in southern Canada, the United States, and Puerto Rico, during December compared with 80 percent of 189 stations in those ranges during last month. This is the lowest percentage of stations with flow in the normal to above-normal range for December in the last 7 years. Total December flow of 1,339,200 cubic feet per second (cfs) for the 179 reporting index stations in the conterminous United States and southern Canada was 17 percent below median, and the lowest for December in the last 7 years, after a 6 percent decrease in streamflow from November to December. Below-normal range streamflow occurred in 26 percent of the area of southern Canada and the conterminous United States during December compared with 22 percent during November, and a high of 60 percent during June.

Only one monthly low, the same number as last month, occurred during December, and there were no December highs. The December mean of 398 cfs (59 percent below median) on the Etowah River at Canton, Georgia (drainage area 613 square miles), was the lowest in 61 years: 17 cfs (4 percent) less than the previous December low which occurred in 1981. Hydrographs for four index stations—three at which new calendar year lows occurred, and also that for the Etowah River—are on page 4.

Precipitation during December 1988 (maps on page 5) varied widely in the United States: less than 50 percent of normal in much of the Pacific Northwest and also in most of the area east of the Appalachian Mountains; and more than 200 percent of normal in several small areas in the midcontinent.

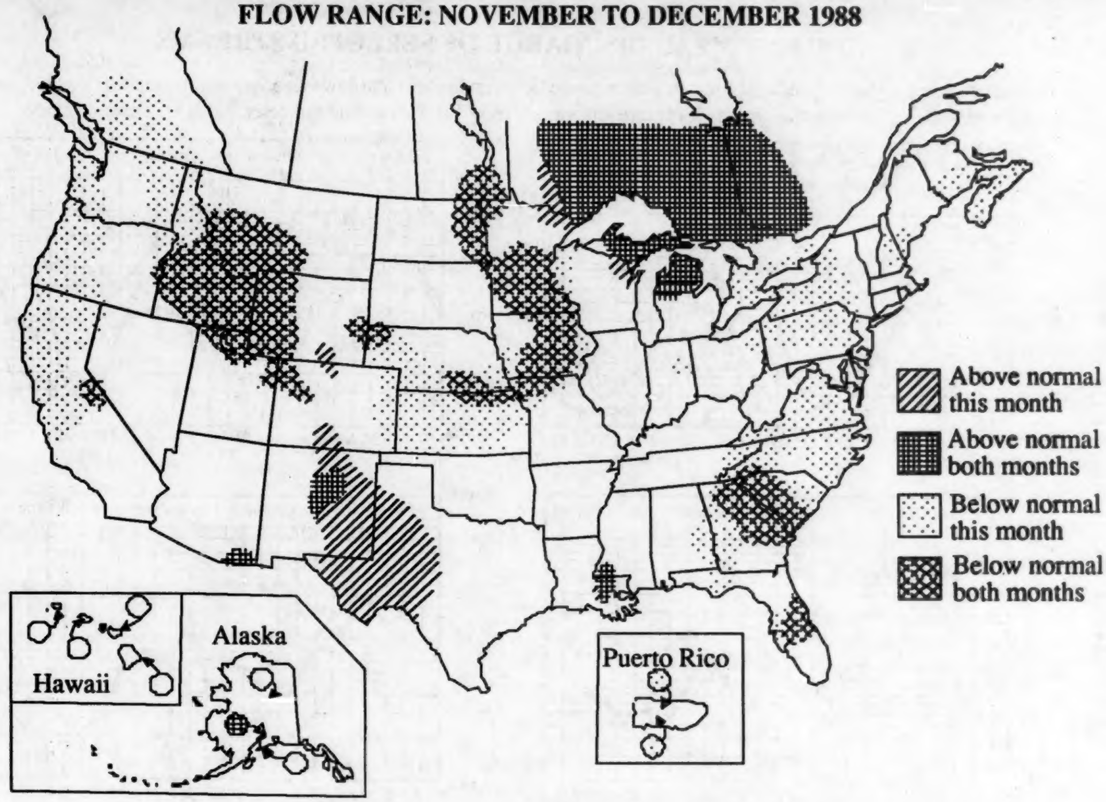
December streamflow ranged from 15 percent below median (Northern Great Plains) to 48 percent below median (California) in five areas (graphs on page 6) affected by the drought. Flow decreased from that for November in all five areas, ranging from 2 percent for the Northern Great Plains to 24 percent for California. Graphs of actual streamflow in the five areas for each month of the 1988 and 1989 water years, and also 1951-80 median streamflow for each month are on page 7.

The combined flow of the 3 largest rivers in the lower 48 States—Mississippi, St. Lawrence, and Columbia—averaged a normal- range 759,800 cfs (9 percent below median), during December after a 14 percent increase from November to December. Flows of the St. Lawrence River and the Mississippi River were in the normal range (for the seventh and second consecutive month, respectively), but flow of the Columbia River was in the below-normal range after a normal-range November. Hydrographs for both the combined and individual flows of the "Big 3" are on page 8. Dissolved solids and water temperatures at five large river stations are also given on page 8. December flow data for the "Big 3" and 42 other large rivers are given in the Flow of Large Rivers table on page 9.

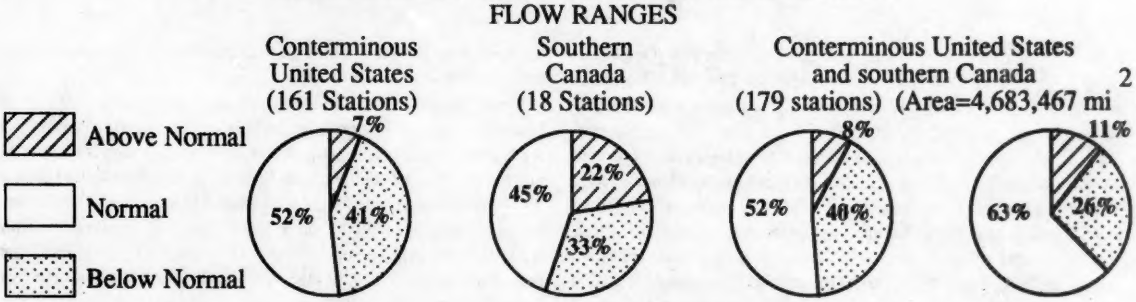
Monthend index reservoir contents for December 1988 were in the below-average range (below the monthend average for the period of record by more than 5 percent of normal maximum contents) at 32 of 100 reporting sites, compared with 28 of 100 during November 1988, including most reservoirs in Maryland, North Dakota, Montana, Wyoming, Idaho, California, and Nevada. Lake Tahoe, straddling California and Nevada, had no usable storage for the third consecutive month. December 1988 contents were significantly lower than those of December 1987 at 42 of the 100 sites, including most sites in the Dakotas, Montana, Wyoming, California, Nevada,Texas, and Oklahoma. In the Southeast, 5 of the 10 index reservoirs with capacities greater than 1,000,000 acre-feet had contents which were less than those of December 1986, the most recent year of drought in that area prior to 1988. Graphs of contents for seven reservoirs are shown on page 10 with contents for the 100 reporting reservoirs given on page 11. (Continued on page 4.)

CONTENTS

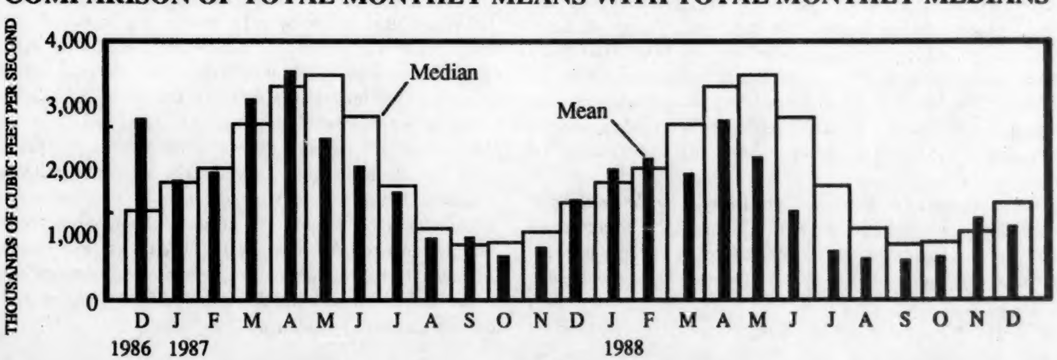
PERSISTENCE IN, OR MOVEMENT INTO, THE BELOW -NORMAL OR ABOVE-NORMAL FLOW RANGE: NOVEMBER TO DECEMBER 1988



SUMMARY OF DECEMBER 1988 STREAMFLOW FLOW RANGES

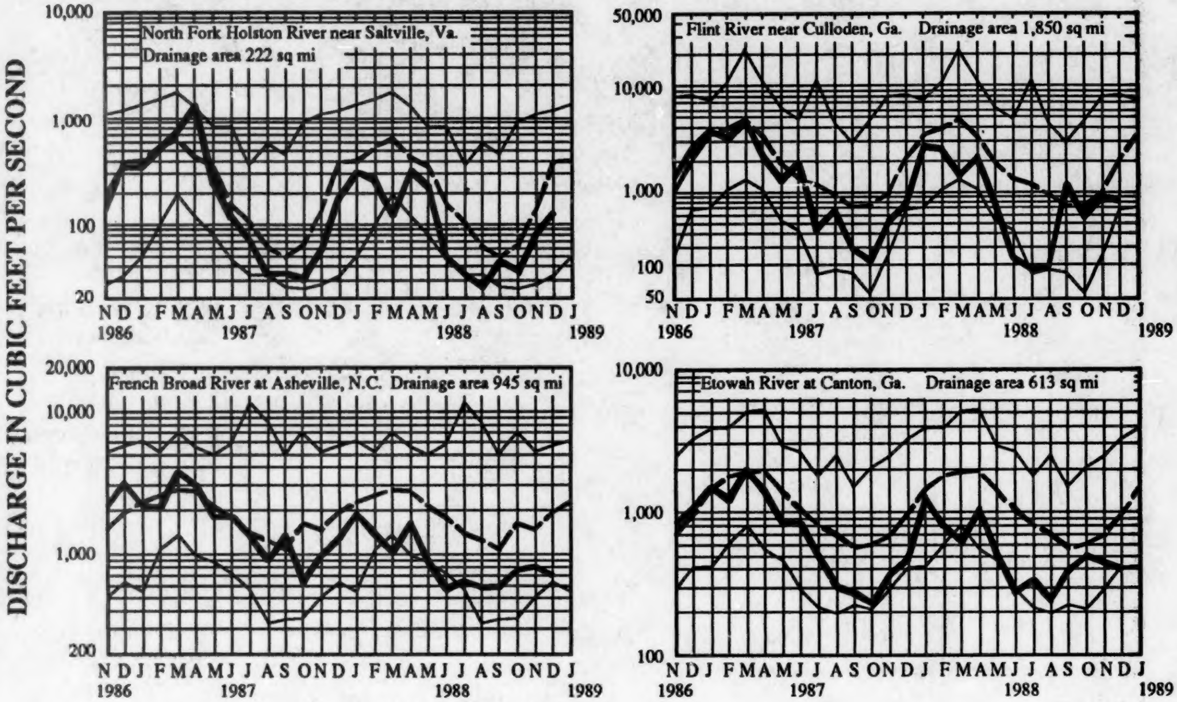


COMPARISON OF TOTAL MONTHLY MEANS WITH TOTAL MONTHLY MEDIANS



MONTHLY MEAN DISCHARGE OF SELECTED STREAMS

Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period.



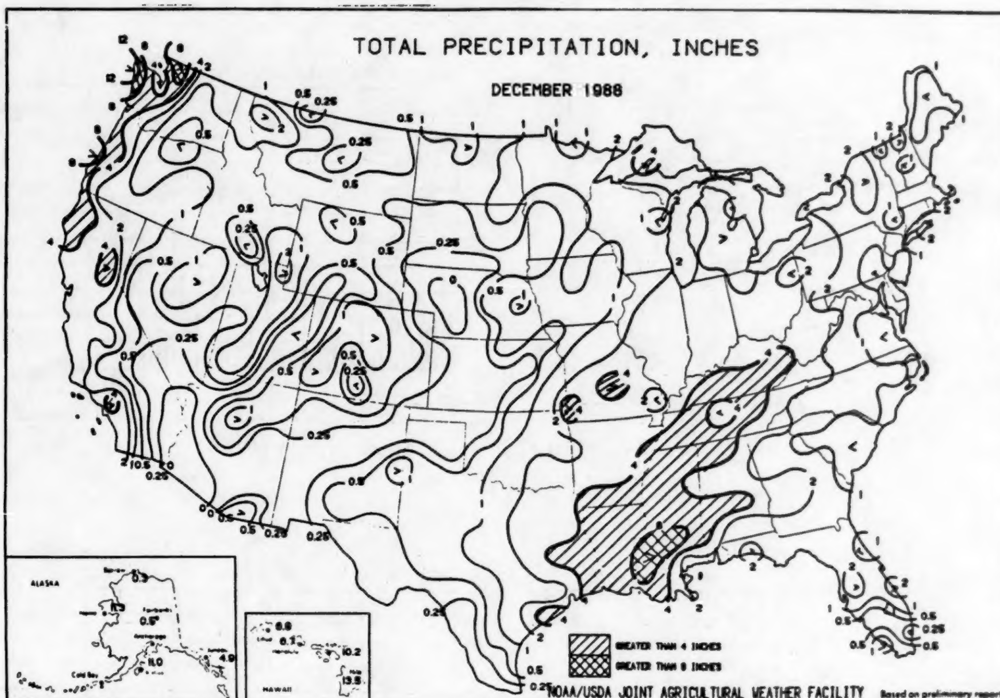
Maps on page 12 show streamflow conditions for Fall (October 1, 1988-December 31, 1988) and also for Calendar Year 1988. New lows for calendar year streamflow occurred at three index stations in the Southeast: the mean of 135 cfs on the North Fork Holston River at Saltville, Virginia (drainage area 222 square miles), was 53 percent below median and 6 cfs less than the previous low, which occurred in 1941 (68 years of record); the mean of 951 cfs on the French Broad River at Asheville, North Carolina (drainage area 945 square miles), was 54 percent below median and 64 cfs less than the previous low, which occurred in 1981 (92 years of record); and the mean of 1,110 cfs on the Flint River near Culloden, Georgia (drainage area 1,850 square miles), was 52 percent below median and 27 cfs less than the previous low, which occurred in 1954 (65 years of record). The combined flow of the 3 largest rivers in the lower 48 States—Mississippi, St. Lawrence, and Columbia—averaged a below-normal range 816,600 cfs (18 percent below median) for the calendar year. Flow of the St. Lawrence River was in the normal range but 5 percent below median. Flows of the Mississippi River (21 percent below median) and the Columbia River (35 percent below median) were in the below-normal range.

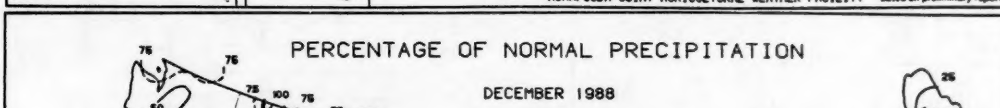
Three pages from the September 1988 issue of the *National Water Conditions* are republished on pages 13-15. The graphs of percent area in the above- and below-normal ranges by water years (top of page 13) and by months (bottom of page 13) are improved graphics with better line definition, particularly the monthly graph. The half-year maps (page 14), 1988 water year map (top of page 15), and the seasonal maps for water year 1988 are published with consistent patterns for the map and pie charts.

Mean December elevations at the four master gages on the Great Lakes (provisional National Ocean Service data) declined from those for November except on Lake Huron. The monthly means were in the normal range on all four lakes, including Superior (which had been in the below-normal range for six consecutive months through October), for the second consecutive month. December 1988 levels ranged from 0.33 foot higher (Lake Superior) to 0.82 foot lower (Lake Huron) than those for December 1987. Stage hydrographs for the master gages on Lakes Superior, Huron, Erie, and Ontario are on page 18.

The elevation of Utah's Great Salt Lake (graph on page 18) declined 0.05 foot to 4,206.45 feet above National Geodetic Vertical Datum (NGVD) of 1929 on December 15, and remained at that level through December 31. The total decline in lake level since the seasonal high of 4,209.55 feet above NGVD of 1929 during February is 3.10 feet. Lake level is 2.95 feet lower than at the end of December 1987 and 5.40 feet lower than the recorded all-time high of 4,211.85 feet above NGVD of 1929, which occurred during July 1986 and was equaled during April 1987. The lake had begun its seasonal rise at this time last year.

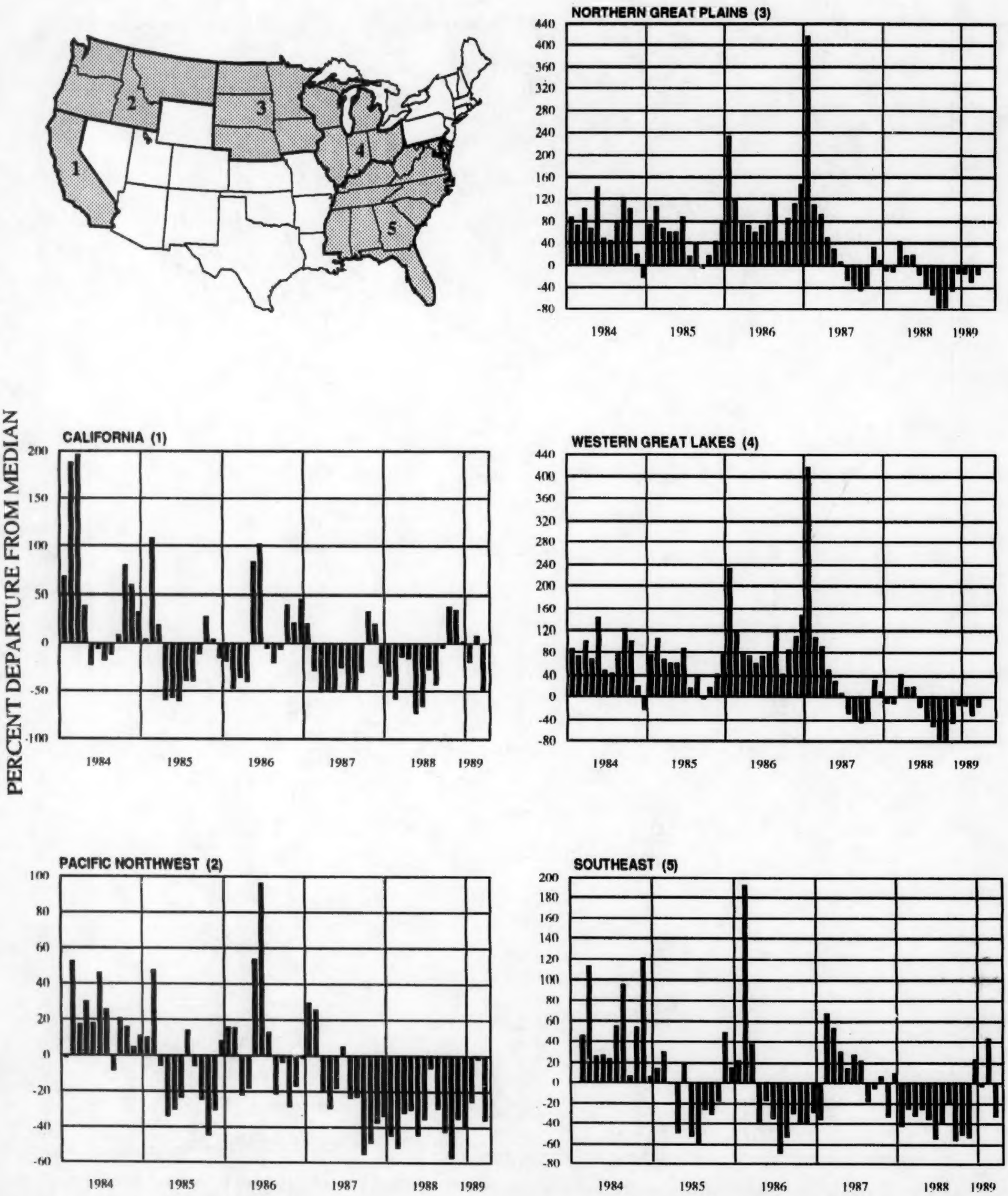
January 1989-March 1989 outlook maps for both temperature and precipitation are on page 19. Precipitation is likely to be above median only in an area from Arkansas to southern West Virginia. Precipitation is likely to be below median in an area from northwestern California to southwestern Arizona and also in coastal areas from southern Texas to South Carolina, including all of Florida.





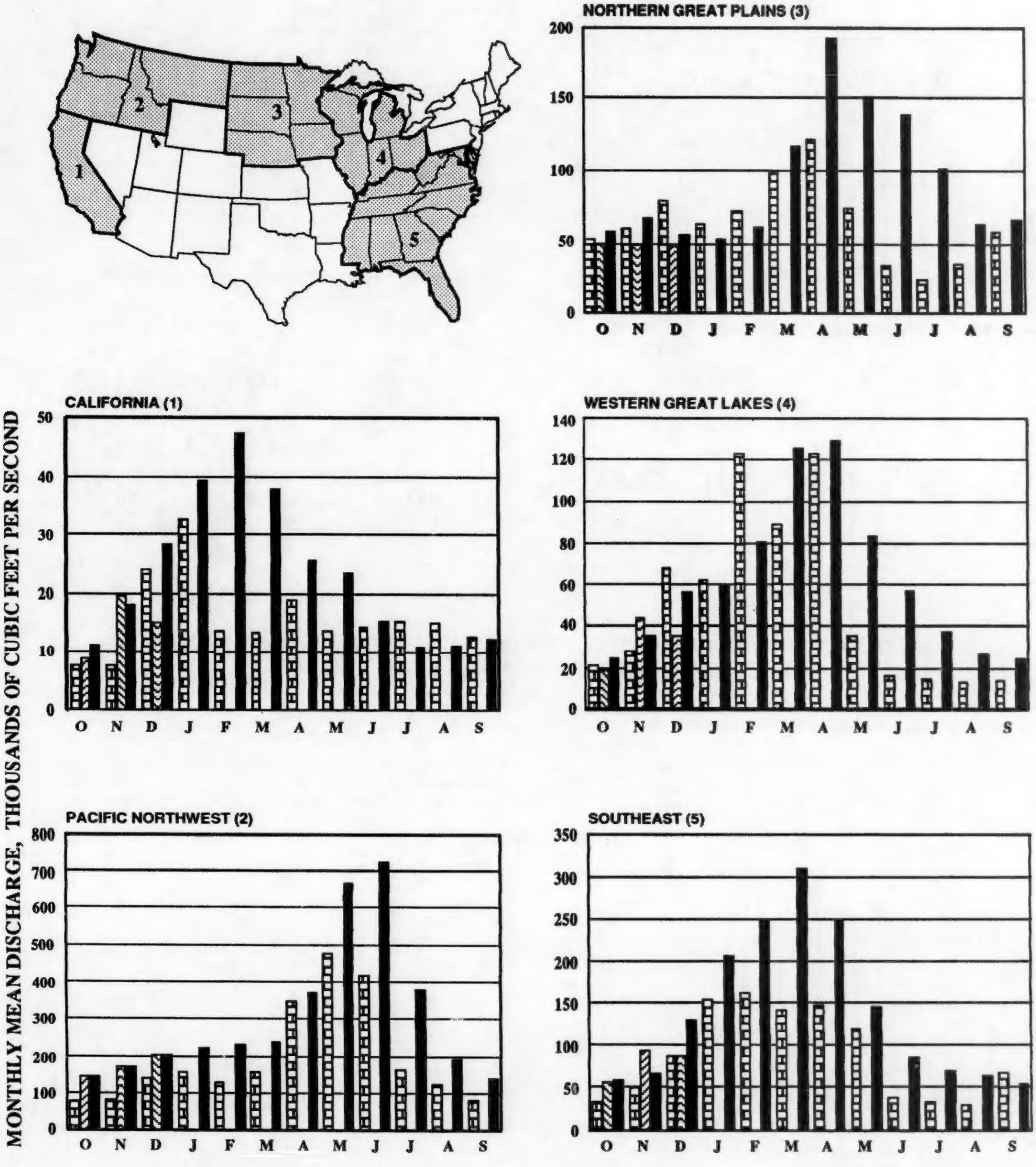
(From *Weekly Weather and Crop Bulletin* prepared and published by the NOAA/USDA Joint Agricultural Weather Facility)

MONTHLY DEPARTURE OF ACTUAL STREAMFLOW (OCTOBER 1983-DECEMBER 1988) FROM MEDIAN STREAMFLOW (1951-80)



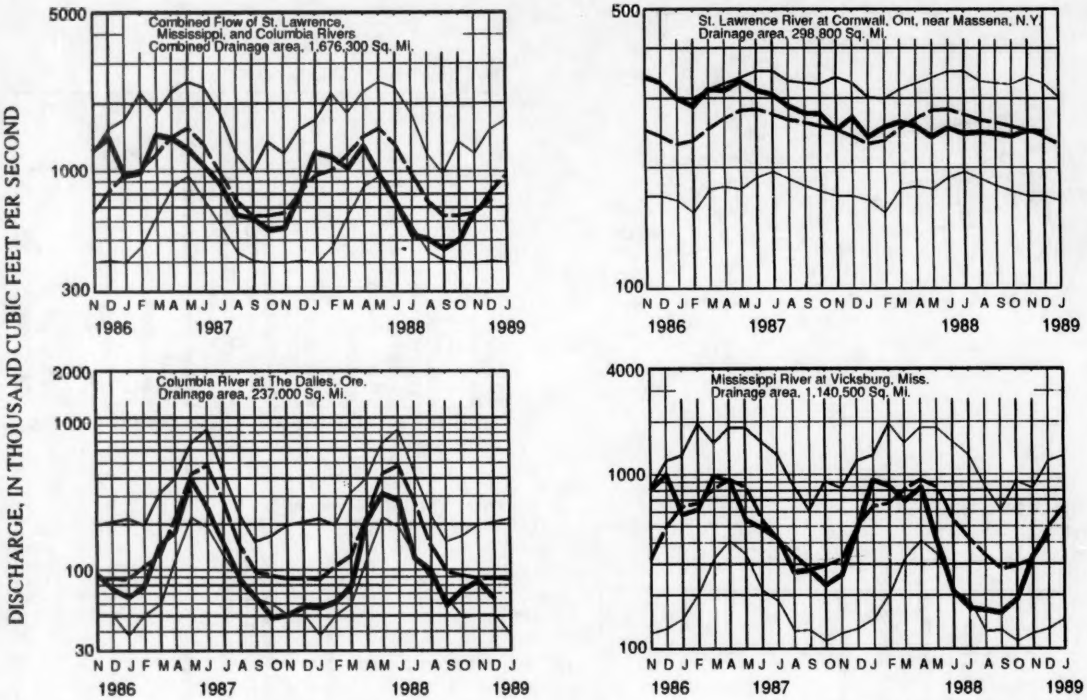
ACTUAL MONTHLY STREAMFLOW, 1988 AND 1989 WATER YEARS,

COMPARED WITH MEDIAN MONTHLY STREAMFLOW, 1951-80



HYDROGRAPHS FOR THE "BIG THREE" RIVERS

Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period.



Provisional data; subject to revision

DISSOLVED SOLIDS AND WATER TEMPERATURES, FOR DECEMBER 1988, AT DOWNSTREAM SITES ON FIVE LARGE RIVERS

Station number	Station name	December data of following calendar years	Stream discharge during month	Dissolved-solids concentration[a]		Dissolved-solids discharge[a]			Water temperature[b]		
			Mean (cfs)	Minimum (mg/L)	Maximum (mg/L)	Mean (tons per day)	Minimum (tons per day)	Maximum (tons per day)	Mean in °C	Minimum in °C	Maximum in °C
01463500	Delaware River at Trenton, N.J. (Morrisville, Pa.)	1988	6,108	98	121	1,824	1,269	2,878	2.5	0.0	6.0
		1944-87	13,190	62	138	----	631	20,500	---	0.0	12.0
		(Extreme yr)		(1983)	(1980)		(1964)	(1973)			
			[c]11,650								
07289000	Mississippi River at Vicksburg, Miss.	1988	449,500	167	343	258,900	130,500	490,800	8.5	6.0	11.0
		1975-87	730,600	153	296	413,900	131,000	712,800	7.5	0.0	13.0
		(Extreme yr)		(1978)	(1987)		(1976)	(1985)			
			[c]495,500								
03612500	Ohio River at lock and dam 53, near Grand Chain, Ill. (streamflow station at Metropolis, Ill.)	1988	201,000	178	301	----	46,000	239,000	---	4.0	9.5
		1954-87	329,600	138	362	----	21,300	469,000	---	0.0	14.0
		(Extreme yr)		(1962)	(1969)		(1980)	(1977)			
			[c]286,000								
06934500	Missouri River at Hermann, Mo. (60 miles west of St. Louis, Mo.)	1988	34,300	329	466	39,200	20,200	58,500	5.0	3.5	7.0
		1975-87	81,240	222	770	80,460	34,600	237,000	3.5	0.0	14.0
		(Extreme yr)		(1982)	(1978)		(1980)	(1982)			
			[c]40,520								
14128910	Columbia River at Warrendale, Oreg. (streamflow station at The Dalles, Oreg.)	1988	155,000	92	104	41,500	34,100	53,200	8.0	6.0	9.5
		1975-87	156,500	82	128	45,800	22,800	77,300	6.5	0.5	10.5
		(Extreme yr)		(1975)	(1984)		(1978)	(1980)			
			[c]87,500								

[a]Dissolved-solids concentrations, when not analyzed directly, are calculated on basis of measurements of specific conductance.
[b]To convert °C to °F: [(1.8 X °C) + 32] = °F.
[c]Median of monthly values for 30-year reference period, water years 1951-80, for comparison with data for current month.

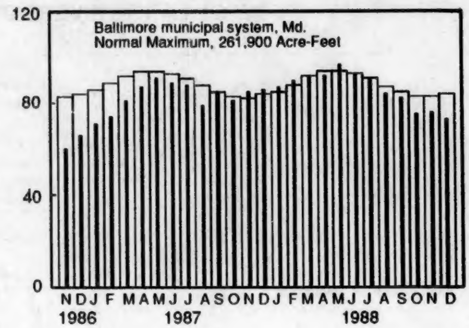
Provisional data; subject to revision

FLOW OF LARGE RIVERS DURING DECEMBER 1988

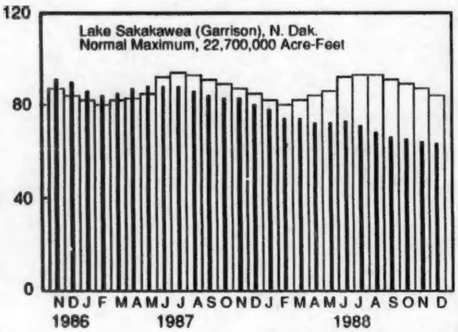
Station number	Stream and place of determination	Drainage area (square miles)	Average discharge through September 1980 (cubic feet per second)	December 1988: Monthly mean discharge (cubic feet per second)	Percent of median monthly discharge 1951-80	Change in discharge from previous month (percent)	Discharge near end of month: Cubic feet per second	Million gallons per day	Date
01014000	St. John River below Fish River at Fort Kent, Maine	5,690	9,647	4,396	90	−67	2,450	1,583	31
01318500	Hudson River at Hadley, N.Y.	1,664	2,909	1,870	75	−64	1,140	736	31
01357500	Mohawk River at Cohoes, N.Y.	3,456	5,734	....	....	....	....	....	..
01463500	Delaware River at Trenton, N.J.	6,780	11,750	6,108	52	−42	5,450	3,522	31
01570500	Susquehanna River at Harrisburg, Pa.	24,100	34,530	15,160	44	−39	22,400	14,480	27
01646500	Potomac River near Washington, D.C.	11,560	[1]11,490	[1]3,240	32	−28	5,900	3,810	31
02105500	Cape Fear River at William O. Huske Lock near Tarheel, N.C.	4,810	5,005	1,626	42	−50	....	....	..
02131000	Pee Dee River at Peedee, S.C.	8,830	9,851	5,510	74	−10	4,860	3,141	31
02226000	Altamaha River at Doctortown, Ga.	13,600	13,880	3,742	47	+8	3,320	2,150	30
02320500	Suwannee River at Branford, Fla.	7,880	6,987	3,019	94	−6	2,830	1,830	31
02358000	Apalachicola River at Chattahoochee, Fla.	17,200	22,570	9,740	57	−6	....	....	..
02467000	Tombigbee River at Demopolis lock and dam near Coatopa, Ala.	15,400	23,300	19,910	98	−4	54,000	34,900	31
02489500	Pearl River near Bogalusa, La.	6,630	9,768	8,386	153	+2	9,230	5,965	31
03049500	Allegheny River at Natrona, Pa.	11,410	[1]19,480	[1]11,900	45	−27	30,400	19,650	26
03085000	Monongahela River at Braddock, Pa.	7,337	[1]12,510	[1]9,860	67	−19	34,800	22,490	26
03193000	Kanawha River at Kanawha Falls, W.Va.	8,367	12,590	7,466	54	+42	11,700	7,560	29
03234500	Scioto River at Higby, Ohio	5,131	4,547	2,940	73	−6	13,200	8,530	30
03294500	Ohio River at Louisville, Ky.[2]	91,170	11,600	97,700	75	−5	273,000	176,400	29
03377500	Wabash River at Mount Carmel, Ill.	28,635	27,220	9,087	40	−27	16,200	10,470	29
03469000	French Broad River below Douglas Dam, Tenn.	4,543	6,798	2,497	38	−11	....	....	..
04084500	Fox River at Rapide Croche Dam, near Wrightstown, Wis.[2]	6,150	4,163	3,487	97	−19	3,206	2,072	31
04264331	St. Lawrence River at Cornwall, Ontario - near Massena, N.Y.[3]	298,800	242,700	246,000	103	0	220,000	142,000	31
02NG001	St. Maurice River at Grand Mere, Quebec	16,300	25,150	16,200	122	−70	23,800	15,380	22
05082500	Red River of the North at Grand Forks, N.Dak.	30,100	2,551	255	22	−22	279	180	27
05133500	Rainy River at Manitou Rapids, Minn.	19,400	11,830	14,500	148	+38	12,500	8,080	22
05330000	Minnesota River near Jordan, Minn.	16,200	3,402	286	44	−11	220	142	31
05331000	Mississippi River at St. Paul, Minn.	36,800	[1]10,610	3,381	70	−12	2,800	1,810	31
05365500	Chippewa River at Chippewa Falls, Wis.	5,600	5,100	2,168	69	−24	1,630	1,053	31
05407000	Wisconsin River at Muscoda, Wis.	10,300	8,617	5,800	89	+3	5,000	3,200	31
05446500	Rock River near Joslin, Ill.	9,551	5,873	5,310	113	+59	5,200	3,360	31
05474500	Mississippi River at Keokuk, Iowa	119,000	62,620	26,730	73	−14	29,300	18,940	31
06214500	Yellowstone River at Billings, Mont.	11,796	7,038	2,190	72	−15	1,380	891	30
06934500	Missouri River at Hermann, Mo.	524,200	79,490	35,350	87	−25	53,500	34,580	31
07289000	Mississippi River at Vicksburg, Miss.[4]	1,140,500	576,600	449,500	91	+35	260,000	168,000	27
07331000	Washita River near Dickson, Okla.	7,202	1,368	822	229	+3	847	547	31
08276500	Rio Grande below Taos Junction Bridge, near Taos, N.Mex.	9,730	725	542	127	−5	515	332	31
09315000	Green River at Green River, Utah	44,850	6,298	1,574	66	−22	....	....	..
11425500	Sacramento River at Verona, Calif.	21,257	18,820	11,717	56	+6	20,320	13,130	26
13269000	Snake River at Weiser, Idaho	69,200	18,050	10,900	70	−8	10,800	6,980	31
13317000	Salmon River at White Bird, Idaho	13,550	11,250	3,120	67	−16	2,860	1,848	31
13342500	Clearwater River at Spalding, Idaho	9,570	15,480	3,820	60	−21	3,430	2,216	31
14105700	Columbia River at The Dalles, Oreg.[5]	237,000	[1]193,100	[1]64,360	74	−23	174,800	113,000	27
14191000	Willamette River at Salem, Oreg.	7,280	[1]23,510	[1]23,340	53	−28	21,790	14,083	28
15515500	Tanana River at Nenana, Alaska	25,600	23,460	7,865	117	−1	7,800	5,040	31
08MF005	Fraser River at Hope, British Columbia.	83,800	96,290	33,120	75	−32	26,660	17,230	30

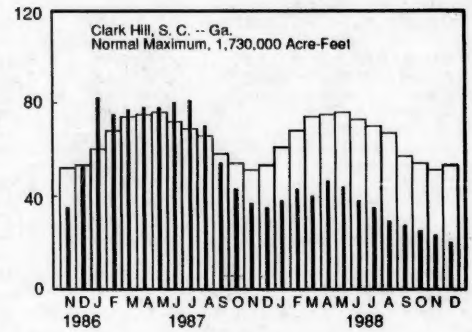
[1]Adjusted.
[2]Records furnished by Corps of Engineers.
[3]Records furnished by Buffalo District, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y., when adjusted for storage in Lake St. Lawrence.
[4]Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.
[5]Discharge determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.

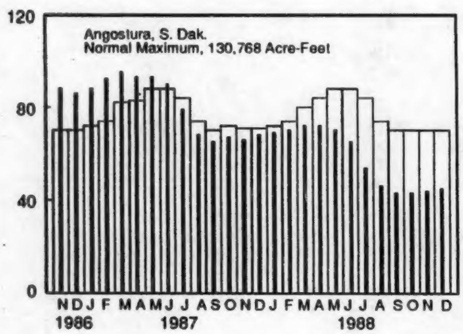
USABLE CONTENTS OF SELECTED RESERVOIRS AND RESERVOIR SYSTEMS

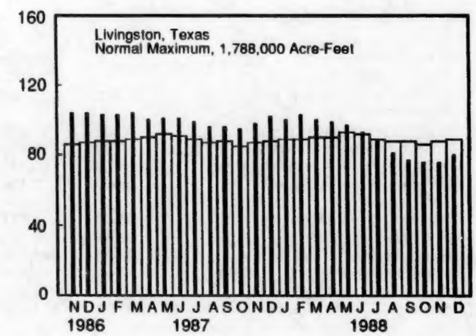


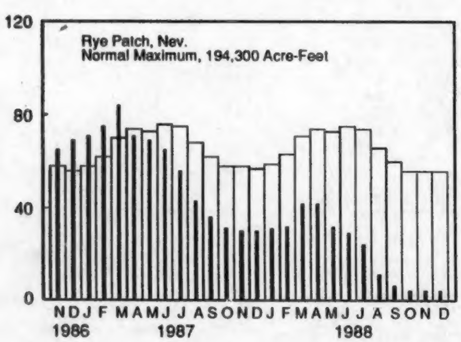
PERCENT OF NORMAL MAXIMUM

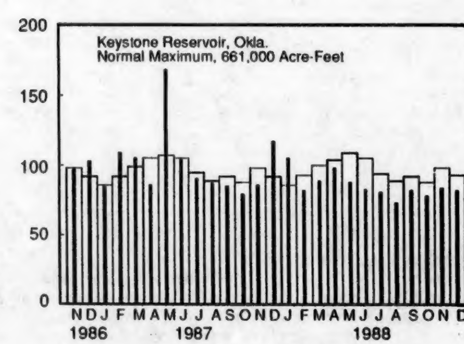












USABLE CONTENTS OF SELECTED RESERVOIRS NEAR END OF DECEMBER 1988

[Contents are expressed in percent of reservoir capacity. The usable storage capacity of each reservoir is shown in the column headed "Normal maximum."]

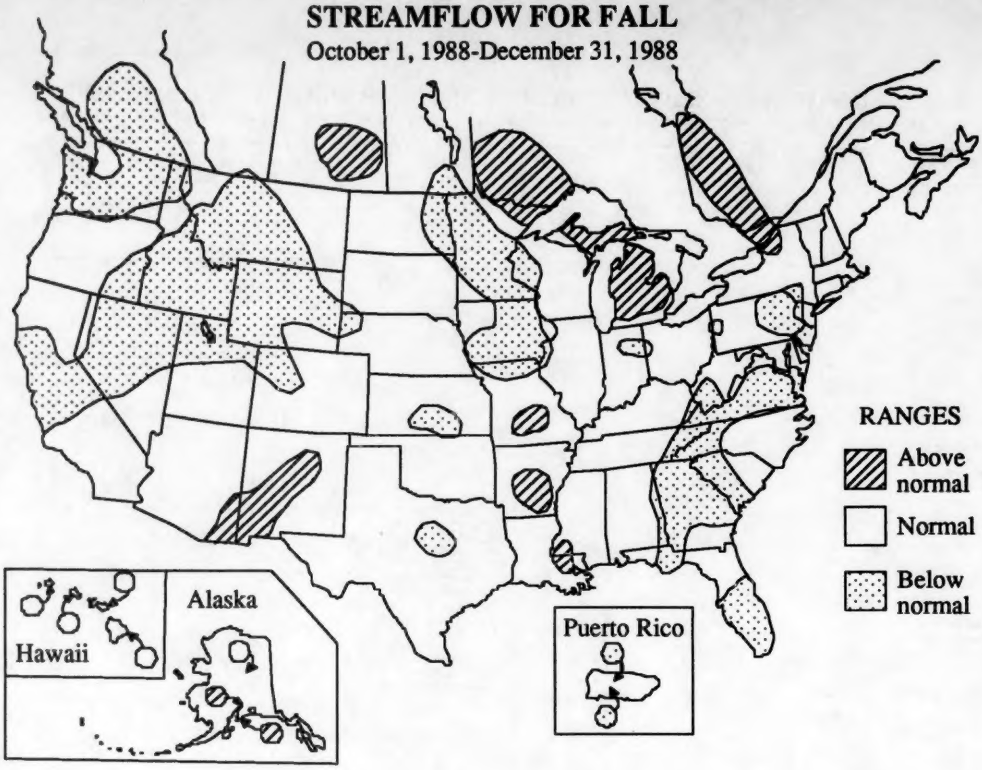
Reservoir Principal uses: F--Flood control I--Irrigation M--Municipal P--Power R--Recreation W--Industrial	Percent of normal maximum: End of Dec. 1988	End of Dec. 1987	Average for end of Dec.	End of Nov. 1988	Normal maximum (acre-feet)[a]
NOVA SCOTIA					
Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs (P)	61	53	50	54	[b]226,300
QUEBEC					
Allard (P)	80	22	58	76	280,600
Gouin (P)	71	48	66	70	6,954,000
MAINE					
Seven reservoir systems (MP)	60	54	57	69	4,107,000
NEW HAMPSHIRE					
First Connecticut Lake (P)	63	66	58	82	76,450
Lake Francis (FPR)	74	75	70	89	99,310
Lake Winnipesaukee (PR)	67	59	62	78	165,700
VERMONT					
Harriman (P)	70	67	60	83	116,200
Somerset (P)	82	80	68	90	57,390
MASSACHUSETTS					
Cobble Mountain and Borden Brook (MP)	77	79	72	81	77,920
NEW YORK					
Great Sacandaga Lake (FPR)	50	69	53	67	786,700
Indian Lake (FMP)	62	59	62	81	103,300
New York City reservoir system(MW)	60	87	82	62	1,680,000
NEW JERSEY					
Wanaque (M)	86	83	72	67	77,450
PENNSYLVANIA					
Allegheny (FPR)	33	31	33	33	1,180,000
Pymatuning (FMR)	85	88	82	92	188,000
Raystown Lake (FR)	66	67	57	67	761,900
Lake Wallenpaupack (PR)	69	57	57	74	157,800
MARYLAND					
Baltimore municipal system (M)	73	86	84	76	261,900
NORTH CAROLINA					
Bridgewater (Lake James) (P)	91	92	78	92	288,800
Narrows (Badin Lake) (P)	94	87	93	93	128,900
High Rock Lake (P)	35	54	60	56	234,800
SOUTH CAROLINA					
Lake Murray (P)	78	75	62	84	1,614,000
Lakes Marion and Moultrie (P)	65	64	61	79	1,862,000
SOUTH CAROLINA--GEORGIA					
Clark Hill (FP)	20	35	53	23	1,730,000
GEORGIA					
Burton (PR)	80	81	54	89	104,000
Sinclair (MPR)	93	88	76	88	214,000
Lake Sidney Lanier (FMPR)	35	38	50	36	1,686,000
ALABAMA					
Lake Martin (P)	73	73	61	80	1,375,000
TENNESSEE VALLEY					
Clinch Projects: Norris and Melton Hill Lakes (FPR)	37	28	31	34	2,293,000
Douglas Lake (FPR)	13	15	11	20	1,394,000
Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes (FPR)	43	67	39	50	1,012,000
Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR)	39	36	33	38	2,880,000
Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR)	44	40	39	39	1,478,000
WISCONSIN					
Chippewa and Flambeau (PR)	89	91	63	91	365,000
Wisconsin River (21 reservoirs) (PR)	59	67	55	64	399,000
MINNESOTA					
Mississippi River headwater system (FMR)	35	29	24	36	1,640,000
NORTH DAKOTA					
Lake Sakakawea (Garrison) (FIPR)	63	80	84	64	22,700,000
SOUTH DAKOTA					
Angostura (I)	45	68	70	44	130,768
Belle Fourche (I)	32	64	44	27	185,200
Lake Francis Case (FIP)	60	57	59	54	4,589,000
Lake Oahe (FIP)	63	82	---	63	22,240,000
Lake Sharpe (FIP)	101	105	98	100	1,697,000
Lewis and Clark Lake (FIP)	96	98	101	100	432,000

Reservoir Principal uses: F--Flood control I--Irrigation M--Municipal P--Power R--Recreation W--Industrial	Percent of normal maximum: End of Dec. 1988	End of Dec. 1987	Average for end of Dec.	End of Nov. 1988	Normal maximum (acre-feet)[a]
NEBRASKA					
Lake McConaughy (IP)	72	76	72	71	1,948,000
OKLAHOMA					
Eufaula (FRP)	97	136	87	94	2,378,000
Keystone (FPR)	82	117	93	84	661,000
Tenkiller Ferry (FPR)	103	154	95	100	628,200
Lake Altus (FIMR)	73	90	49	66	133,000
Lake O'The Cherokees (FPR)	90	118	81	86	1,492,000
OKLAHOMA--TEXAS					
Lake Texoma (FMPRW)	87	105	90	88	2,722,000
TEXAS					
Bridgeport (IMW)	58	81	48	59	386,400
Canyon (FMR)	97	89	79	96	385,600
International Amistad (FIMPW)	103	100	85	102	3,497,000
International Falcon (FIMPW)	166	104	76	104	2,668,000
Livingston (IMW)	80	102	89	76	1,788,000
Possum Kingdom (IMPRW)	71	66	96	72	570,200
Red Bluff (PI)	58	71	30	57	307,000
Toledo Bend (P)	84	85	84	78	4,472,000
Twin Buttes (FIM)	71	80	32	70	177,800
Lake Kemp (IMW)	63	86	85	64	268,000
Lake Meredith (FWM)	42	36	37	42	796,900
Lake Travis (FIMPRW)	80	134	80	81	1,144,000
MONTANA					
Canyon Ferry (FIMPR)	70	75	85	70	2,043,000
Fort Peck (FPR)	68	81	84	70	18,910,000
Hungry Horse (FIPR)	47	59	76	49	3,451,000
WASHINGTON					
Ross (PR)	65	52	69	74	1,052,000
Franklin D. Roosevelt Lake (IP)	46	77	94	79	5,022,000
Lake Chelan (PR)	62	46	55	74	676,100
Lake Cushman (PR)	56	62	82	82	359,500
Lake Merwin (P)	98	101	96	85	245,600
IDAHO					
Boise River (4 reservoirs) (FIP)	29	30	57	25	1,235,000
Coeur d'Alene Lake (P)	28	24	55	51	238,500
Pend Oreille Lake (FP)	28	33	48	25	1,561,000
IDAHO--WYOMING					
Upper Snake River (8 reservoirs) (MP)	34	43	60	26	4,401,000
WYOMING					
Boysen (FIP)	61	79	75	59	802,000
Buffalo Bill (IP)	37	45	67	35	421,300
Keyhole (F)	27	40	42	27	193,800
Pathfinder, Seminoe, Alcova, Kortes, Glendo, and Guernsey Reservoirs(I)	53	58	49	52	3,056,000
COLORADO					
John Martin (FIR)	27	74	19	24	364,400
Taylor Park (IR)	67	71	55	71	106,200
Colorado-Big Thompson project (I)	65	69	58	65	730,300
COLORADO RIVER STORAGE PROJECT					
Lake Powell; Flaming Gorge, Fontenelle, Navajo, and Blue Mesa Reservoirs (IFPR)	84	85	---	85	31,620,000
UTAH--IDAHO					
Bear Lake (IPR)	56	70	59	56	1,421,000
CALIFORNIA					
Folsom (FIP)	24	30	54	20	1,000,000
Hetch Hetchy (MP)	41	46	37	51	360,400
Isabella (FIR)	13	25	26	13	568,100
Pine Flat (FI)	10	19	47	8	1,001,000
Clair Engle Lake (Lewiston) (P)	52	67	73	50	2,438,000
Lake Almanor (P)	64	71	50	66	1,036,000
Lake Berryessa (FIMW)	62	72	79	60	1,600,000
Millerton Lake (FI)	36	42	54	31	503,200
Shasta Lake (FIPR)	40	67	68	41	4,377,000
CALIFORNIA--NEVADA					
Lake Tahoe (IPR)	0	31	48	0	744,600
NEVADA					
Rye Patch (I)	4	30	56	4	194,300
ARIZONA--NEVADA					
Lake Mead and Lake Mohave(FIMP)	88	93	71	87	27,970,000
ARIZONA					
San Carlos (IP)	47	55	23	47	935,100
Salt and Verde River system(IMPR)	79	80	42	79	2,019,100
NEW MEXICO					
Conchas (FIR)	80	91	79	80	315,700
Elephant Butte and Caballo (FIPR)	87	92	36	85	2,442,000

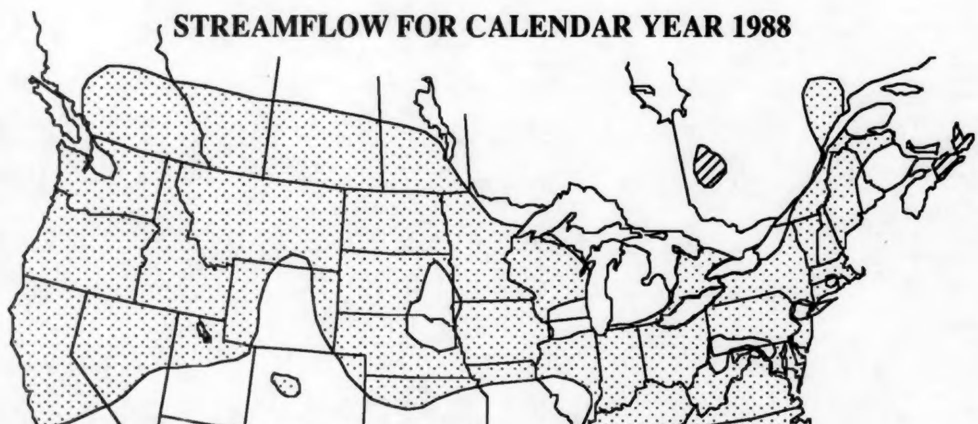
[a]1 acre-foot = 0.04356 million cubic feet = 0.326 million gallons = 0.504 cubic feet per second day.
[b]Thousands of kilowatt-hours (the potential electric power that could be generated by the volume of water in storage).

STREAMFLOW FOR FALL

October 1, 1988-December 31, 1988

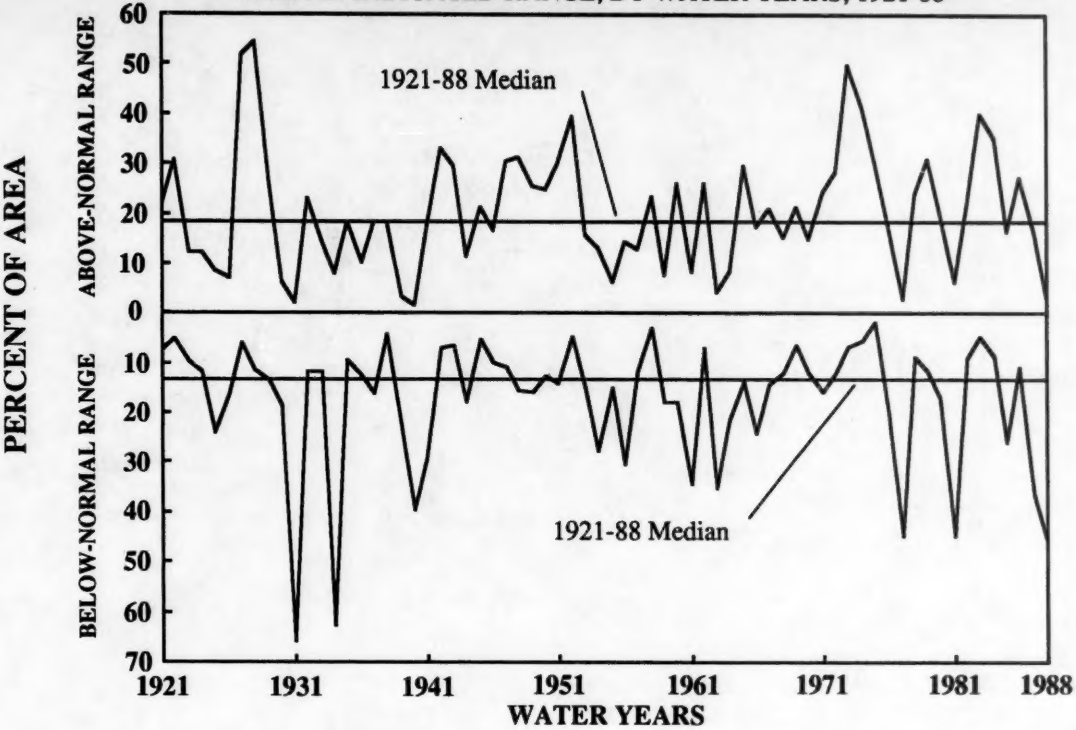


STREAMFLOW FOR CALENDAR YEAR 1988

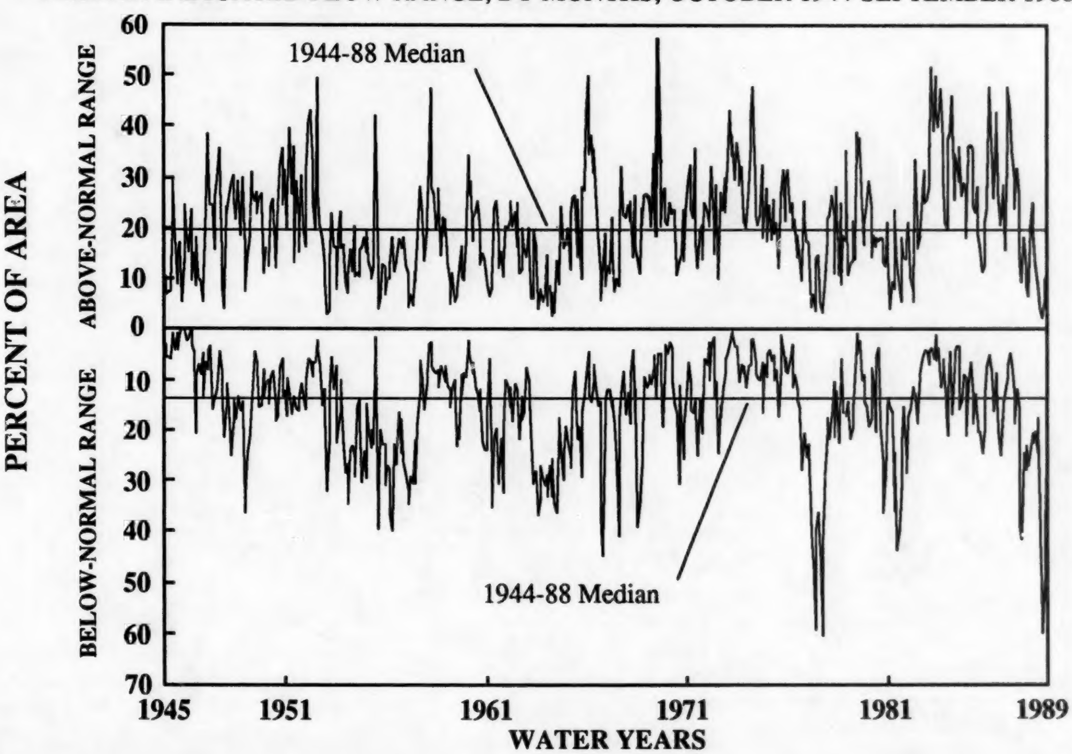


SOUTHERN CANADA AND THE CONTERMINOUS UNITED STATES

AREA IN INDICATED RANGE, BY WATER YEARS, 1921-88

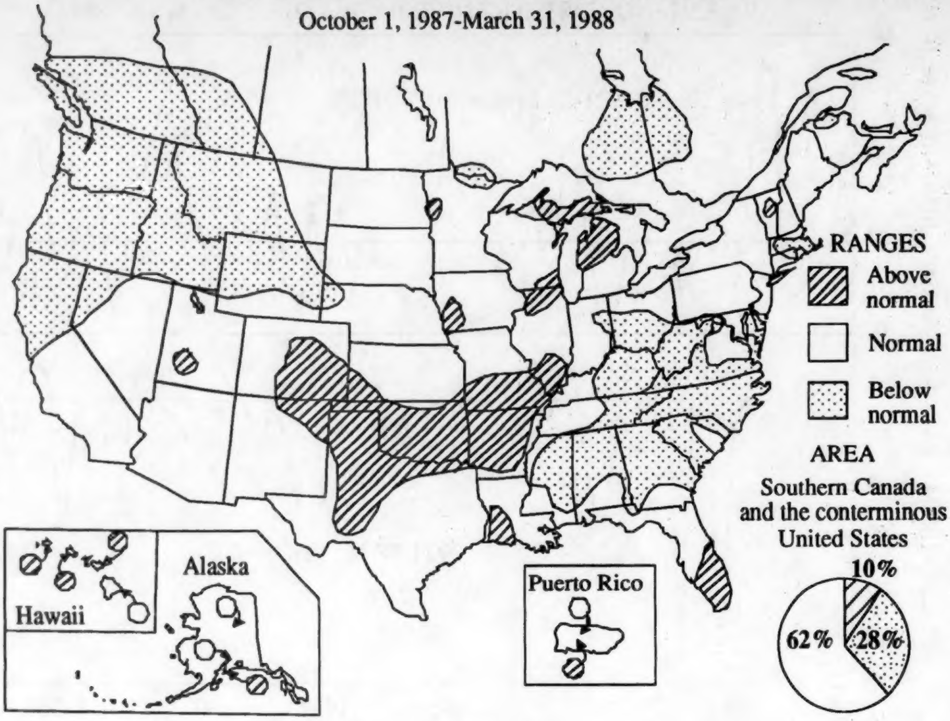


AREA IN INDICATED FLOW RANGE, BY MONTHS, OCTOBER 1944-SEPTEMBER 1988



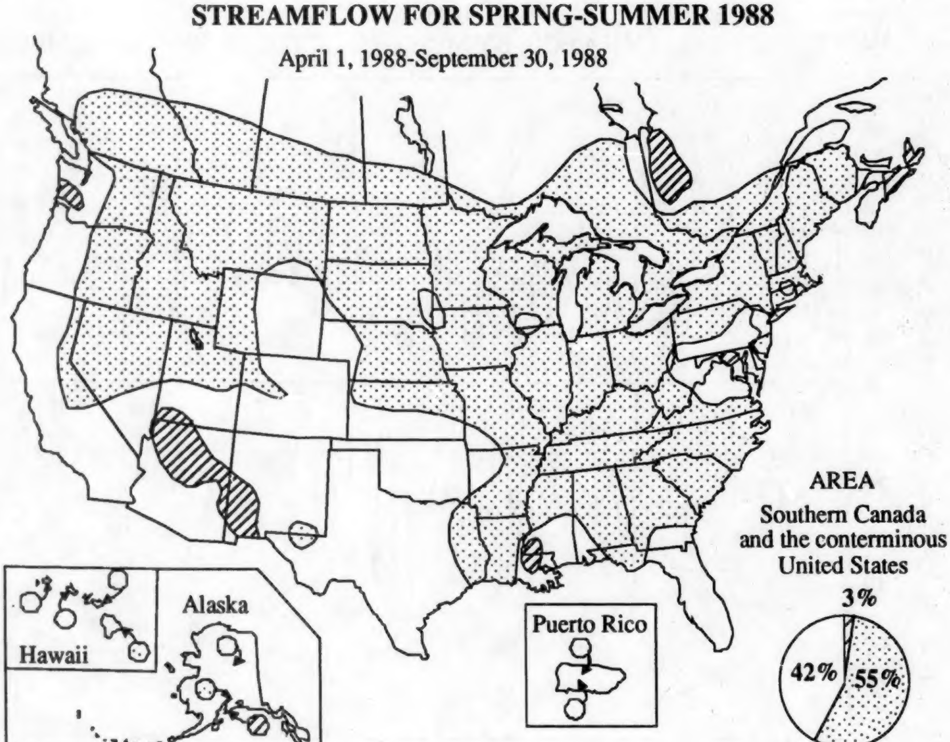
STREAMFLOW FOR FALL-WINTER 1988

October 1, 1987-March 31, 1988



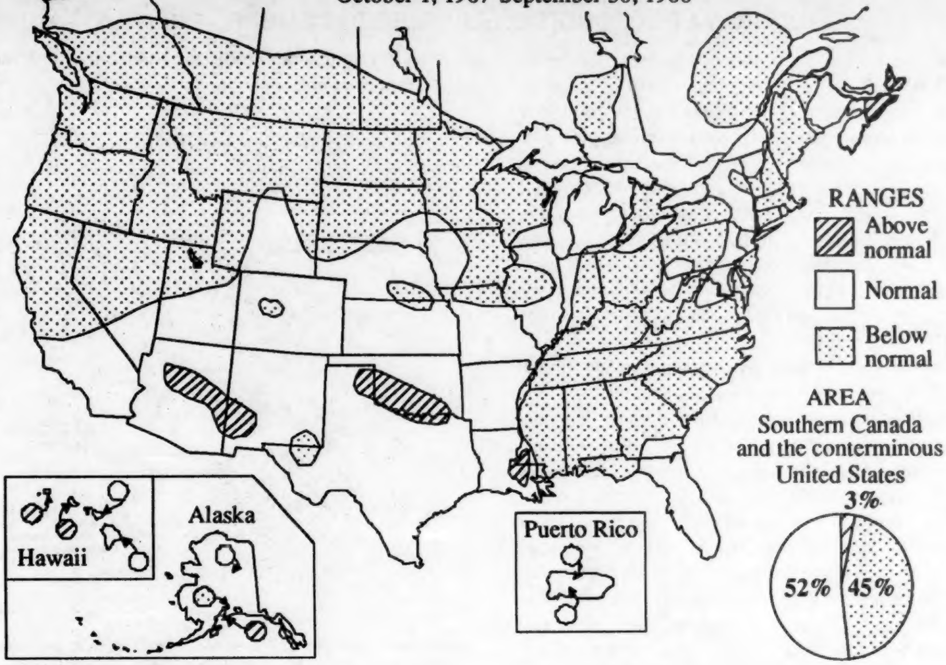
STREAMFLOW FOR SPRING-SUMMER 1988

April 1, 1988-September 30, 1988



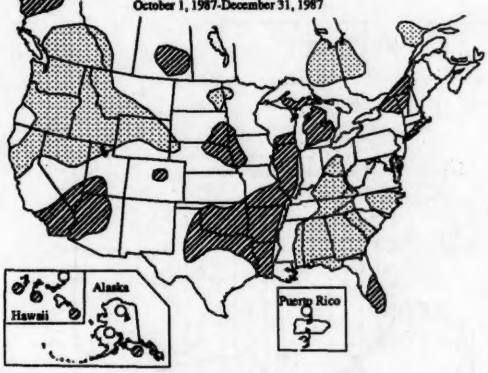
STREAMFLOW FOR WATER YEAR 1988

October 1, 1987-September 30, 1988



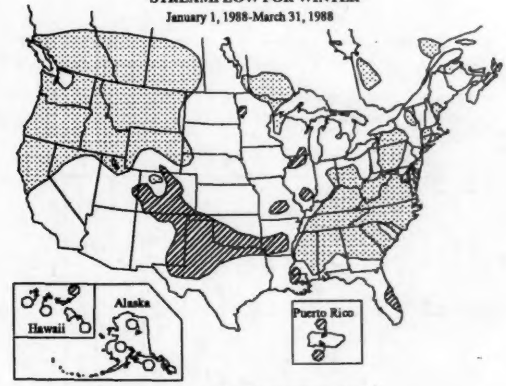
STREAMFLOW FOR FALL

October 1, 1987-December 31, 1987



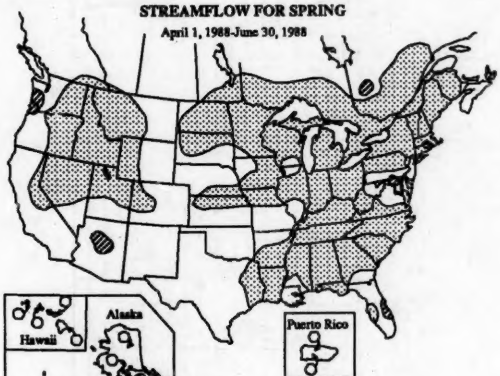
STREAMFLOW FOR WINTER

January 1, 1988-March 31, 1988



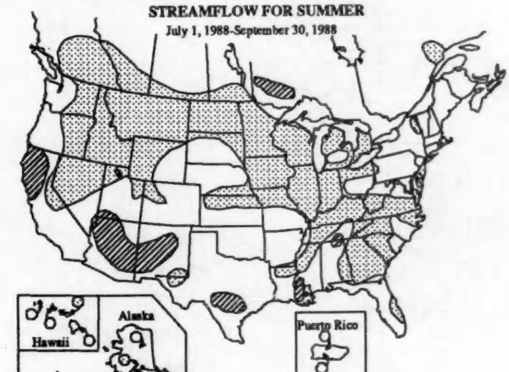
STREAMFLOW FOR SPRING

April 1, 1988-June 30, 1988



STREAMFLOW FOR SUMMER

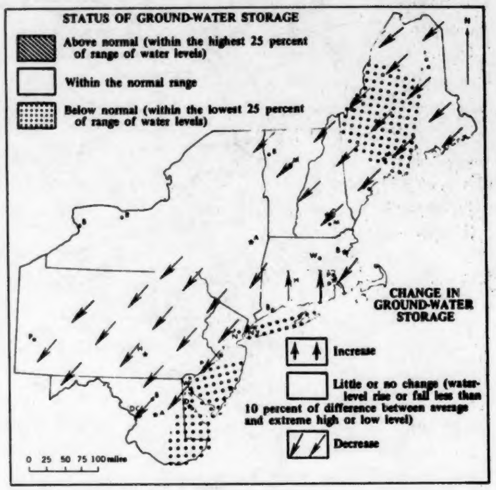
July 1, 1988-September 30, 1988



GROUND-WATER CONDITIONS DURING DECEMBER 1988

Declining water levels replaced the rising trend of November in most of the Northeast because of lessened rates of recharge resulting from near-freezing temperatures in parts of the region and below-normal precipitation. A principal exception to the changed ground-water trend was south-central New England, where water levels rose in many wells. (See map.) Below-average water level conditions persisted in Delaware, southern New Jersey, and on Long Island, New York, and levels were below-average also in much of Maine. Elsewhere in the Northeast, water levels were generally within the average range of December levels.

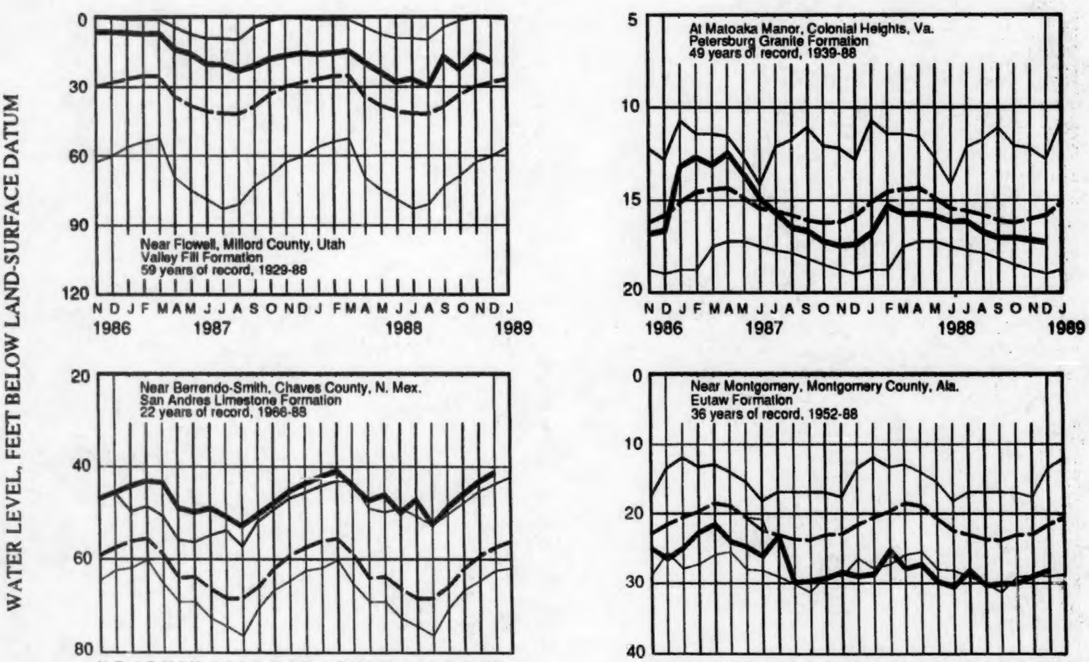
In the Southeastern States, ground-water levels rose in Arkansas and Mississippi and declined in Kentucky. Net changes in levels were mixed in West Virginia, Virginia, North Carolina, Louisiana, and Georgia. Water levels were above long-term averages in Kentucky, and below average in Virginia, Arkansas, and Louisiana. Water levels were mixed with respect to average in West Virginia, North Carolina, and Florida. New December lows occurred in Fairfax County, Virginia, in Ruston, in Northern Louisiana, and tn the Cockspur Island well in the Savannah area, Georgia. In addition, new December lows occurred in key wells in Memphis, western Tennessee, and in Stuttgart, east-central Arkansas, despite net rises during the month of less than a foot and more than 12 feet, respectively.



Map showing ground-water storage near end of December and change in ground-water storage from end of November to end of December.

MONTHEND GROUND-WATER LEVELS IN KEY WELLS

Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates average of monthly levels in previous years. Heavy line indicates level for current period.



In the central and western Great Lakes States, groung-water levels changed variably in Minnesota, Michigan, Ohio, and Iowa, but declined in Wisconsin. Levels were mixed with respect to average in Michigan, and below average in Minnesota, Wisconsin, and Iowa. Levels in Ohio were about average to below average. Despite a net decline of almost a foot in the key well at Ishpeming, in Marquette County, Michigan, a new high for December occurred.

In the Western States, ground-water levels rose in Washington, Nebraska, Nevada, and New Mexico. Mixed water-level changes occurred in Idaho, southern California, Utah, Kansas, Arizona, and Texas. Water levels were below long-term averages in Idaho, southern California, Kansas, Arizona, and Texas. Levels were mixed with respect to average in Washington, Nebraska, Nevada, Utah, and New Mexico. New high water levels for December occurred in the Blanding well in Utah, and in the Berrendo-Smith well in New Mexico. New lows for December occurred in key wells in Las Vegas Valley, Nevada; in the Holladay and Logan wells in Utah; in the well at the Kansas Agricultural Experiment Station in Colby, Kansas; and in the key well in the El Paso area in western Texas. All of these new December lows occurred despite net rises in levels during the month. A new all-time low occurred in the Wyndmere key well in eastern North Dakota (25 years of record).

Provisional data; subject to revision

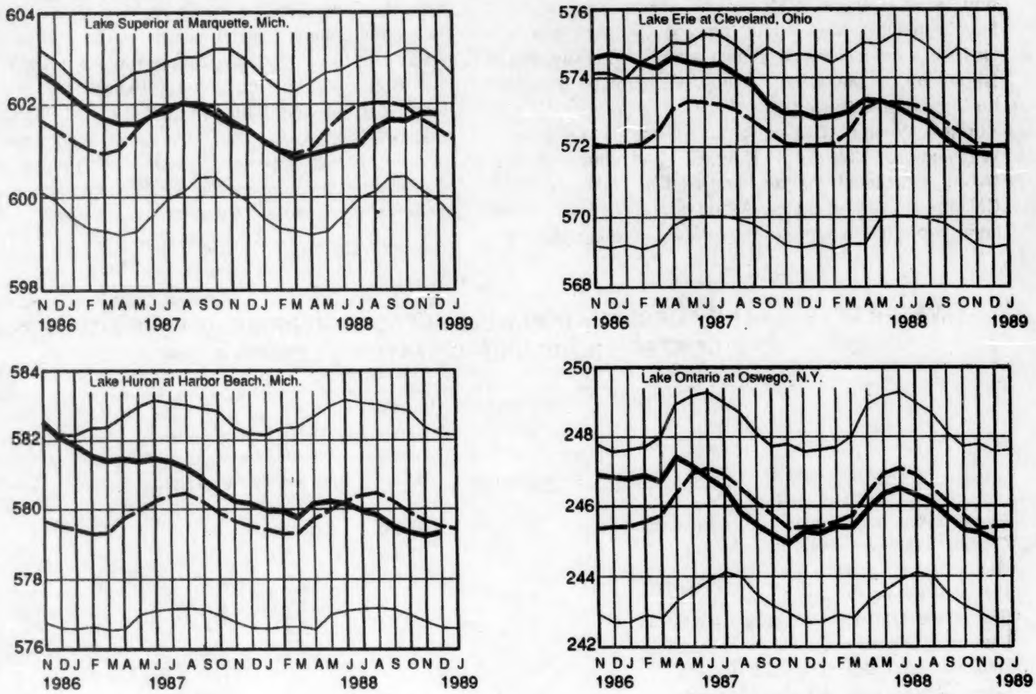
WATER LEVELS IN KEY OBSERVATION WELLS IN SOME REPRESENTATIVE AQUIFERS IN THE CONTERMINOUS UNITED STATES--DECEMBER 1988

Aquifer and Location	Water level in feet with reference to land-surface datum	Departure from average in feet	Net change in water level in feet since: Last month	Last year	Year records began	Remarks
Glacial drift at Hanska, south-central Minnesota	–11.70	–3.28	+2.25	+0.42	1942	
Glacial drift at Roscommon in north-central part of Lower Peninsula, Michigan.	–4.18	+0.64	–0.24	+0.72	1935	
Glacial drift at Marion, Iowa	–8.08	–1.91	–1.86	–5.43	1941	
Glacial drift at Princeton in northwestern Illinois	–8.65	+5.26	–2.45	–2.75	1943	
Petersburg Granite, southeastern Piedmont near Fall Zone, Colonial Heights, Virginia.	–17.29	–1.32	–0.13	+0.10	1939	
Glacial outwash sand and gravel, Louisville, Kentucky (U.S. well no. 2).	–20.61	+4.46	–0.08	–1.32	1946	
500-foot sand aquifer near Memphis, Tennessee (U.S. well no. 2).	–107.21	–17.02	+0.39	–0.72	1941	Dec. low.
Weathered granite, Mocksville area, Davie County, western Piedmont, North Carolina.	–19.68	+2.86	–1.50	–1.18	1932	
Sparta Sand in Pine Bluff industrial area, Arkansas	–242.10	–33.62	+1.00	–7.30	1958	
Eutaw Formation in the City of Montgomery, Alabama (U.S. well no. 4).	–28.1	–6.2	+0.9	+0.9	1952	
Upper Floridan aquifer on Cockspur Island, Savannah area, Georgia (U.S. well no. 6).	–35.78	–8.65	–0.27	–2.34	1956	Dec. low.
Sand and gravel in Puget Trough, Tacoma, Washington.	–105.06	+4.35	+0.87	–1.03	1952	
Pleistocene glacial outwash gravel, North Pole, northern Idaho (U.S. well no. 3).	–469.1	–7.6	–0.6	–3.2	1929	
Snake River Group: Snake River Plain Aquifer, at Eden, Idaho (U.S. well no. 4).	–123.9	–6.3	–1.9	–3.3	1957	
Alluvial valley fill in Flowell area, Millard County, Utah (U.S. well no. 9).	–19.44	+6.99	–3.24	–3.69	1929	
Alluvial sand and gravel, Platte River Valley, Ashland, Nebraska (U.S. well no. 6).	–7.97	–1.85	+0.03	–3.72	1935	
Alluvial valley fill in Steptoe Valley, Nevada	–7.18	+5.40	+0.30	–0.09	1950	
Pleistocene terrace deposits in Kansas River valley, at Lawrence, northeastern Kansas.	–23.49	–2.80	+0.02	–3.39	1953	
Alluvium and Paso Robles clay, sand, and gravel, Santa Maria Valley, California.	–146.17	–3.48	–9.37	–17.99	1957	
Valley fill, Elfrida area, Douglas, Arizona (U.S. well no. 15).	–100.70	–19.30	+0.15	+1.80	1951	
Hueco bolson, El Paso area, Texas	–268.55	–20.03	+1.85	–1.66	1965	Dec. low.
Evangeline aquifer, Houston area, Texas	–304.90	–2.50	+2.80	–2.68	1965	

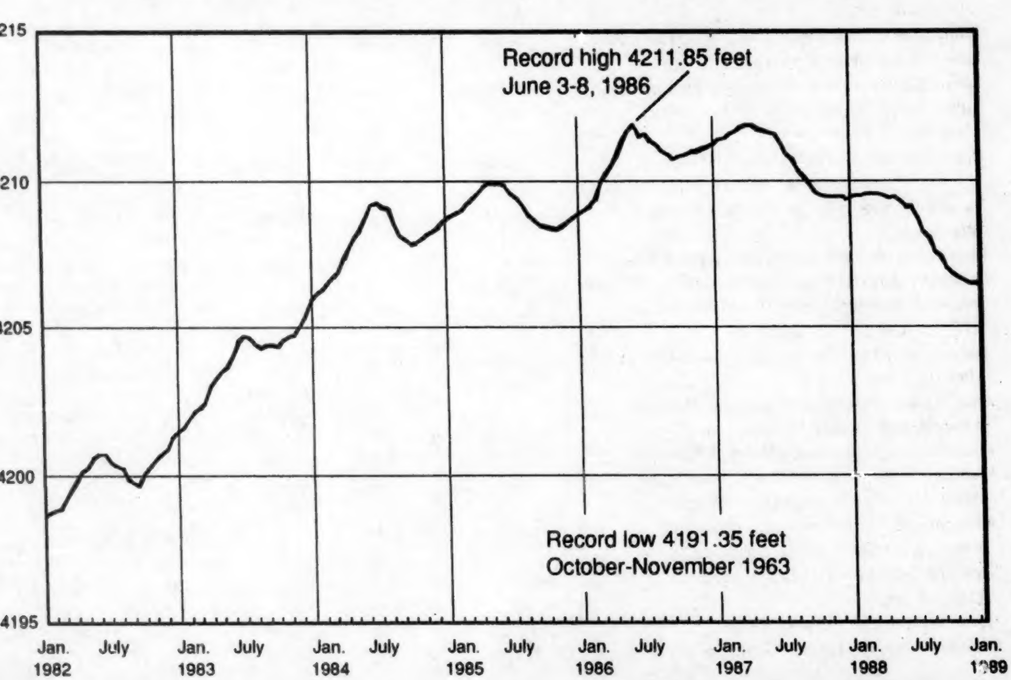
GREAT LAKES ELEVATIONS

Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period. Data from National Ocean Service.

ELEVATION, IN FEET ABOVE NATIONAL GEODETIC VERTICAL DATUM OF 1929

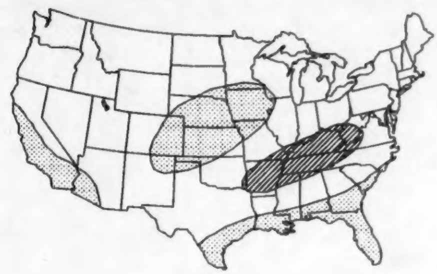


Fluctuations of Great Salt Lake, January 1982 through December 1988



TEMPERATURE OUTLOOK FOR JANUARY THROUGH MARCH 1989

PRECIPITATION OUTLOOK FOR JANUARY THROUGH MARCH 1989



NATIONAL WATER CONDITIONS

DECEMBER 1988

Based on reports from the Canadian and U.S. Field offices; completed January 24, 1989

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EXPLANATION OF DATA (Revised January 1988)

Cover map shows generalized pattern of streamflow for the month based on provisional data from 183 index gaging stations--18 in Canada, 163 in the United States, and 2 in the Commonwealth of Puerto Rico. Alaska, Hawaii, and Puerto Rico inset maps show streamflow only at the index gaging stations that are located near the point shown by the arrows. Classifications on map are based on comparison of streamflow for the current month at each index station with the flow for the same month in the 30-year reference period, 1951-80. Shorter reference periods are used for one Canadian index station, two Kansas index stations, one New York index station, and the Puerto Rico index stations because of the limited records available.

The *persistence/change map* shows where streamflow has persisted in the above- or below-normal range from last month to this month and also where streamflow is in the above- or below-normal range this month after being in a different range last month. The pie charts show percent of stations reporting discharges in each flow range for the conterminous United States, southern Canada, the two areas combined, and also the percent of area in each flow range for the conterminous United States and southern Canada. The bar graph shows total mean and total median flow for all reporting stations in the conterminous United States and southern Canada.

The comparative data are obtained by ranking the 30 flows for each month of the reference period in order of decreasing magnitude--the highest flow is given a ranking of 1 and the lowest flow is given a ranking of 30. Quartiles (25-percent points) are computed by averaging the 7th and 8th highest flows (upper quartile), 15th and 16th highest flows (middle quartile and median), and the 23rd and 24th highest flows (lower quartile). The upper and lower quartiles set off the highest 25 percent of flows and lowest 25 percent of flows, respectively, for the reference period. The median (middle quartile) is the middle value by definition. For the reference period, 50 percent of the flows are greater than the median, 50 percent are less than the median, 50 percent are between the upper and lower quartiles (in the normal range), 25 percent are greater than the upper quartile (above normal), and 25 percent are less than the lower quartile (below normal). Flow for the current month is then classified as: *above normal* if it is greater than the upper quartile, *in the normal range* if it is between the upper and lower quartiles, and *below normal* if it is less than the lower quartile. Change in flow from the previous month to the current month is classified as *seasonal* if the change is in the same direction as the change in the median. If the change is in the opposite direction of the change in the median, the change is classified as *contraseasonal* (opposite to the seasonal change). For example: at a particular index station, the January median is greater than the December median; if flow for the current January increased from December (the previous month), the increase is seasonal; if flow for the current January decreased from December, the decrease is contraseasonal.

Flood frequency analyses define the relation of flood peak magnitude to probability of occurrence or recurrence interval. *Probability of occurrence* is the chance that a given flood magnitude will be exceeded in any one year. *Recurrence interval* is the reciprocal of probability of occurrence and is the *average* number of years between occurrences. For example, a flood having a probability of occurrence of 0.01 (1 percent) has a recurrence interval of 100 years. *Recurrence intervals imply no regularity of occurrence*; a 100-year flood might be exceeded in consecutive years or it might not be exceeded in a 100-year period.

Statements about *ground-water levels* refer to conditions near the end of the month. The water level in each key observation well is compared with average level for the end of the month determined from the 30-year reference period, 1951-80, or from the entire past record for that well when only limited records are available. Comparative data for ground-water levels are obtained in the same manner as comparative data for streamflow. *Changes in ground-water levels*, unless described otherwise, are from the end of the previous month to the end of the current month.

Dissolved solids and temperature data for December are given for five stream-sampling sites that are part of the National Stream Quality Accounting Network (NASQAN). *Dissolved solids* are minerals dissolved in water and usually consist predominately of silica and ions of calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulfate, chloride, and nitrate. *Dissolved-solids discharge* represents the total daily amount of dissolved minerals carried by the stream. *Dissolved-solids concentrations* are generally higher during periods of low streamflow, but the highest dissolved-solids *discharges* occur during periods of high streamflow because the total quantities of water, and therefore total load of dissolved minerals, are so much greater than at times of low flow.

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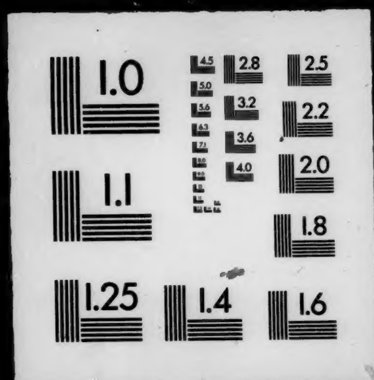
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